Early rupture and degeneration of cryopreserved arterial allografts

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Arterial allografts are used in vascular surgery to solve a major problem: vascular reconstruction in the infected area. To palliate the unavailability and to reduce the risk of viral disease transmission, vascular allografts are currently cryopreserved and stored in tissue banks. In our recent clinical experience, we observed several cases of rupture and degeneration of cryopreserved arterial allografts. All indications are that current cryopreservation protocols are probably the cause for these degenerations. (J Vasc Surg 1997; 25:751-2.)

Prosthetic infection is one of the most serious complications of vascular surgery. It requires removal of the infected material and raises the problem of downstream revascularization. It entails high morbidity, amputation, and mortality rates. To reduce such risks, it has been proposed to replace the infected graft by human arterial vessel collected from clinically dead patients.[1,2]

At present, to reduce the risks of viral disease transmission by allografts, these are frozen and cryopreserved for at least 4 months before transplantation. This lag phase makes it possible to discard contaminated grafts collected from donors whose initial serologic results were negative but whose transplanted organ has induced seroconversion in a recipient.

In our recent experience, we observed three cases of early rupture from a few minutes to a few hours after surgery and two cases of early major dilation of so-preserved arterial allografts. In the first case, rupture occurred six hours after replacement of an infected aortic graft and caused the sudden death of the patient. At autopsy, a lengthwise rupture of the aortic allograft was found, away from the anastomotic areas. In the second case, rupture occurred at the end of surgery; the allograft, implanted in an aortic position, exhibited a lengthwise tear in its middle part, which required immediate repair. In the third case, rupture occurred 8 hours after replacement of an infected femoropopliteal bypass graft; the patient underwent reoperation for hemorrhage at the operative site. A lengthwise tear of the femoral allograft was found in its proximal part. In the fourth and fifth cases, a voluminous aneurysm of an iliac and a femoral cryopreserved artery were noted at 1 month. The first patient underwent reoperation; the iliac aneurysm was excluded, and microbiologic culture results were negative.

These five cases raise the problem of the reliability of cryopreserved grafts. Current cryopreservation protocols are probably responsible for making allografts more brittle, as suggested in a recent study that showed alterations on thawed arterial segments not yet implanted. This experimental study, which involved cryopreservation of 197 cattle vessel specimens, elicited macroscopic intimomedial fissures with approximately a 10% incidence[3] and numerous transverse and stepped microfissures, smaller than a micron, by scanning electronic microscopy. By studying the mechanical and viscoelastic properties of 34 vessels before and after cryopreservation, marked variations of the elastic modulus after cryopreservation were noted. These variations were correlated to the freezing temperature gradient; they are thought to correspond to architectural changes of the arterial wall. By provoking alterations in the vessel walls, cryopreservation could therefore induce graft rupture on dilation as in our cases.

Late degeneration of allografts[4] and disruption or

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aneurysm formation in infected grafts[5] has been well documented, but these cases of early rupture and degeneration of cryopreserved allografts have not been documented in the literature and raise serious questions. Even if the risks of viral disease transmission appear to be reduced, it should still be considered that implanting cryopreserved arterial grafts still carries a risk of secondary rupture. Using new cryprotecting agents or a wider freezing temperature gradient may perhaps solve that problem in the near future.

REFERENCES

1. Bahnini A, Ruotolo C, Koskas F, Kieffer E. In situ fresh allograft replacement of an infected aortic prosthetic graft: eighteen-months' follow-up. J Vasc Surg 1991;14:98-102.
2. Kieffer E, Plissonier D, Bahnini A, Koskas F. Abdominal aortic graft excision and in situ allograft replacement. In: Calligaro K, Veith F, editors. Management of infected arterial grafts. St. Louis: Quality Medical Publishing, 1994:114-23.
3. Lehalle B, Geschier C, Fiévé G, Stoltz JF. Occurrence of fissures in vascular allograft wall after cryopreservation. Cryobiology (in press).
4. Szilagyi DE, Rodriguez FT, Smith RF, Elliott JP. Late fate of arterial allografts: observations 6 to 15 years after implantation. Arch Surg 1970;101:721-33.
5. Quinones-Baldrich WJ, Gelabert HA. Autogenous tissue reconstruction in the management of aorto-ilio-femoral graft infection. Ann Vasc Surg 1990;4:223-8.

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